




Biosecurity and nucleic acid synthesis screening

Biosecurity Knowledge Day

Piers Millett

My goal: knowing who is using what biological capabilities and to do what helps **manage risks of accidental or deliberate misuse**

The background is a solid teal color. It features several white geometric shapes: a large semi-circle on the left side, a large circle on the right side, and several smaller circles and arcs scattered throughout the lower half of the image. The text is centered in the upper-middle portion of the frame.

WHY THINK ABOUT MISUSE



United Nations

Office for Disarmament Affairs

AREAS OF WORK

ABOUT UNODA

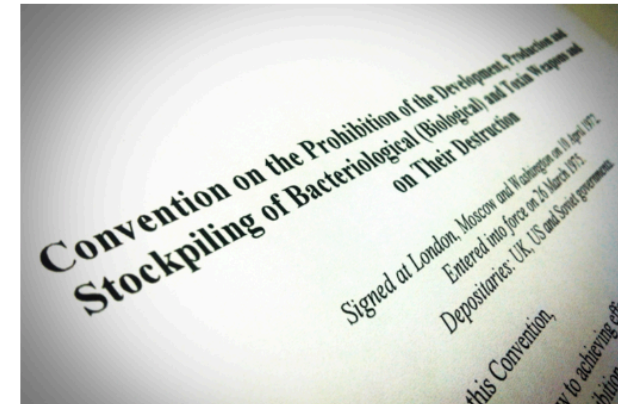
MEETINGS AND DISARMAMENT BODIES

DATABASE AND RESEARCH TOOLS

The Biological Weapons Convention

The Biological Weapons Convention (BWC) effectively prohibits the development, production, acquisition, transfer, stockpiling and use of biological and toxin weapons. It was the first multilateral disarmament treaty banning an entire category of weapons of mass destruction (WMD).

The BWC is a key element in the international community's efforts to address WMD proliferation and it has established a strong norm against biological weapons. The Convention has reached almost universal membership with 187 States Parties and four Signatory States.



[Biological Weapons Convention](#)



1540 Committee

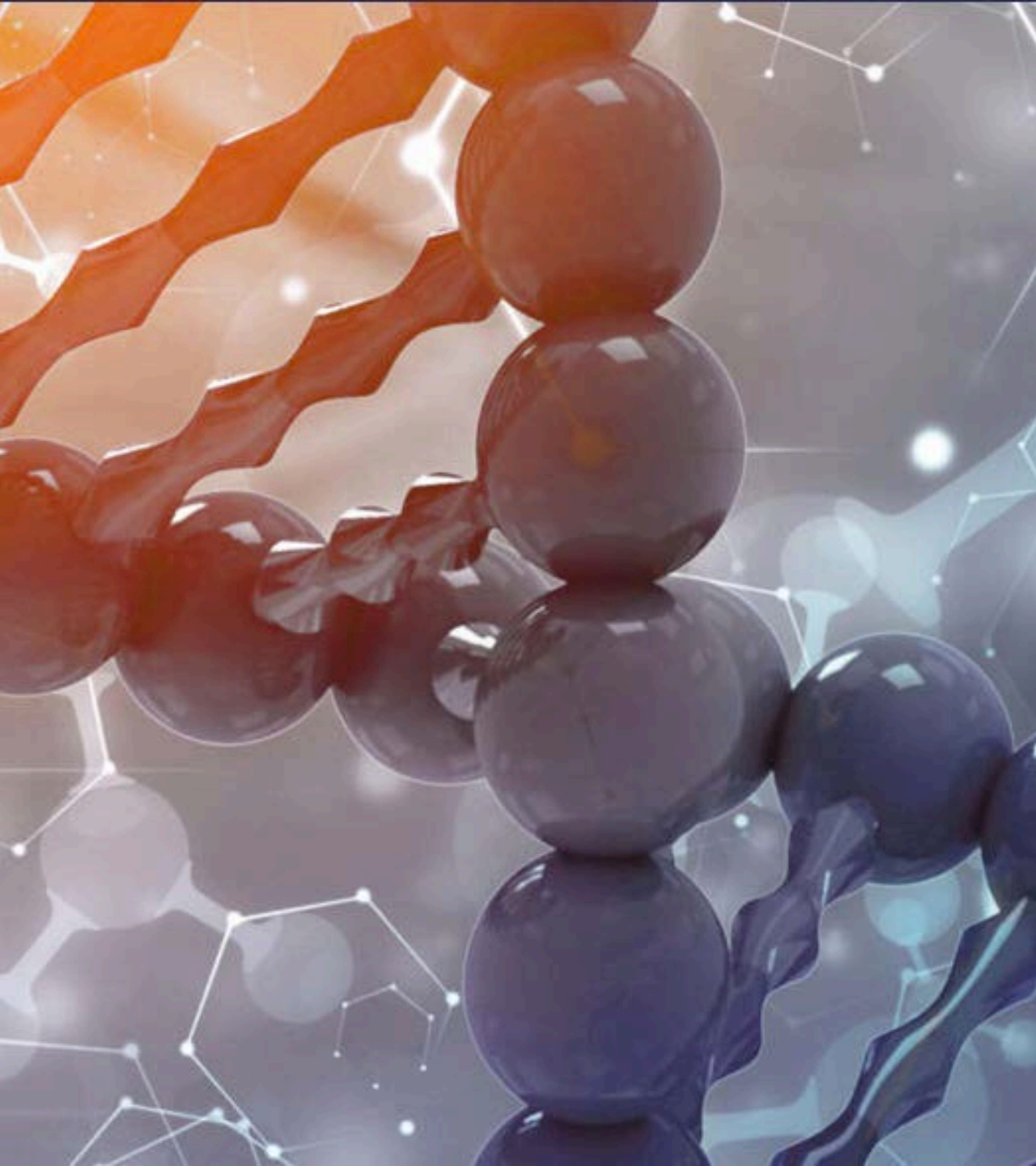
Security Council Committee established pursuant to resolution 1540 (2004)

RESOLUTIONS, COMMITTEE REPORTS & SC BRIEFINGS	ABOUT 1540 COMMITTEE	NATIONAL IMPLEMENTATION	ASSISTANCE	COOPERATION	TRANSPARENCY & OUTREACH	COMPREHENSIVE & ANNUAL REVIEWS
Home		FAQ			Contact us	



Ambassador José Javier De La Gasca (center), Chair of the 1540 Committee, with participants of the 2024 United Nations Disarmament Fellowship Programme, United Nations Headquarters, New York, United States on 16 October 2024.

José Javier De La Gasca
1540 Committee Chair,
Ambassador Extraordinary and
Plenipotentiary Permanent
Representative of Ecuador to the
United Nations



Why think about potential harms from misuse of your capabilities?

Accidental harm

Deliberate misuse

From hazard identification to risk management

Fast progress on AI



HELENA
Biosecurity Age of AI Chairperson

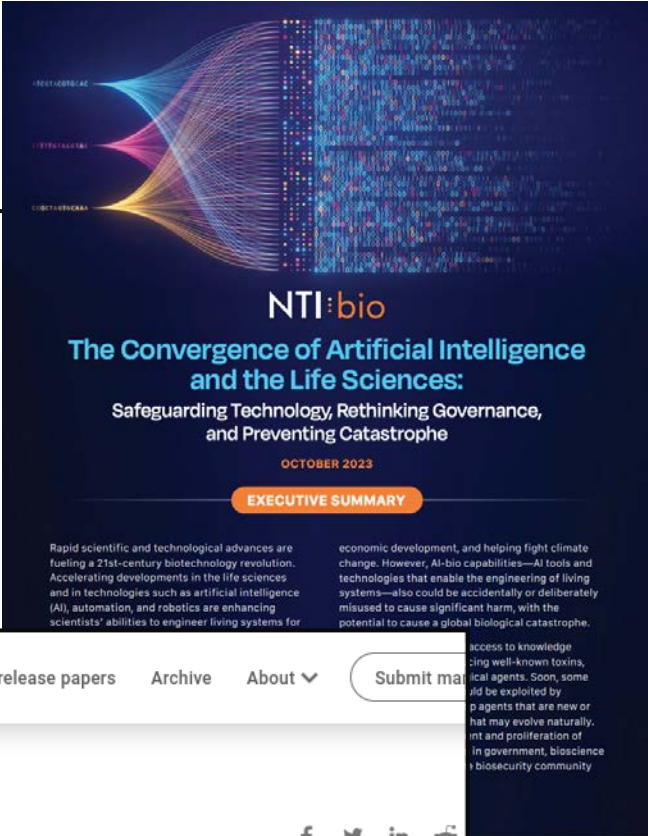
Convened by Helena at The Rockefeller Foundation's Bellagio Center | July 2023
Chairperson: The Hon. Mark Dybul, MD



THE WHITE HOUSE

OCTOBER 30, 2023

FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence

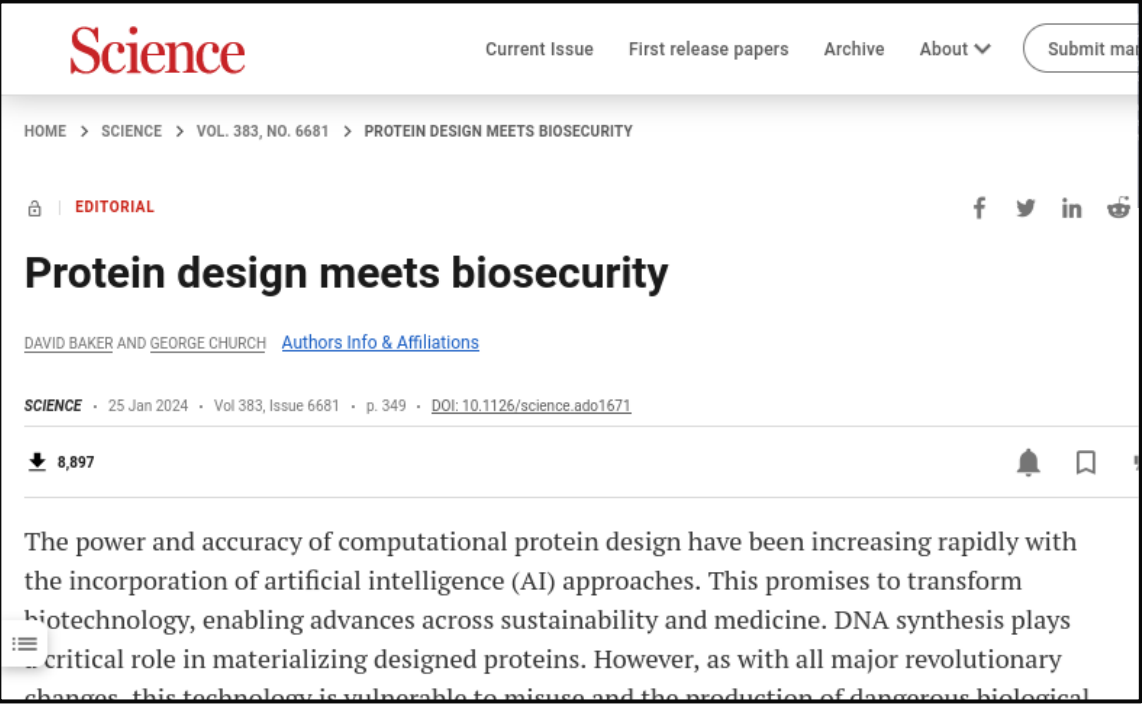


NTI:bio
The Convergence of Artificial Intelligence and the Life Sciences:
Safeguarding Technology, Rethinking Governance, and Preventing Catastrophe

OCTOBER 2023

EXECUTIVE SUMMARY

Rapid scientific and technological advances are fueling a 21st-century biotechnology revolution. Accelerating developments in the life sciences and in technologies such as artificial intelligence (AI), automation, and robotics are enhancing scientists' abilities to engineer living systems for economic development, and helping fight climate change. However, AI-bio capabilities—AI tools and technologies that enable the engineering of living systems—also could be accidentally or deliberately misused to cause significant harm, with the potential to cause a global biological catastrophe.



Science Current Issue First release papers Archive About Submit

HOME > SCIENCE > VOL. 383, NO. 6681 > PROTEIN DESIGN MEETS BIOSECURITY

EDITORIAL

Protein design meets biosecurity

DAVID BAKER AND GEORGE CHURCH [Authors Info & Affiliations](#)

SCIENCE • 25 Jan 2024 • Vol 383, Issue 6681 • p. 349 • DOI: 10.1126/science.ado1671

8,897

The power and accuracy of computational protein design have been increasing rapidly with the incorporation of artificial intelligence (AI) approaches. This promises to transform biotechnology, enabling advances across sustainability and medicine. DNA synthesis plays a critical role in materializing designed proteins. However, as with all major revolutionary changes, this technology is vulnerable to misuse and the production of dangerous biological

No 10 worried AI could be used to create advanced weapons that escape human control

At global summit in UK, Rishi Sunak will highlight risk of criminals and terrorists using technology to make bioweapons



Officials are increasingly concerned about the misuse of AI to create bioweapons and the need for regulation to mitigate this. Photograph: Ignatiev/Getty Images

Convergence: Artificial intelligence and the new and old weapons of mass destruction

By Emilia Javorsky, Hamza Chaudhry | August 10, 2023



Emilia Javorsky
Emilia Javorsky MD, MPH is the Director of the Futures Program at the Future of Life Institute. She is also a scientist and mentor at the Wyss... [Read More](#)

Hamza Chaudhry
Hamza is US Policy Specialist at the Future of Life Institute. Based in Washington DC, his role involves driving engagement with the US Government... [Read More](#)

GEN Genetic Engineering & Biotechnology News

Mutating Virus Variant

MaryAnn Liebert, Inc.  publishers

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What happens when things go well



The Guardian
Newspaper of the year

News Opinion Sport Culture Lifestyle More ▾

Weapons technology

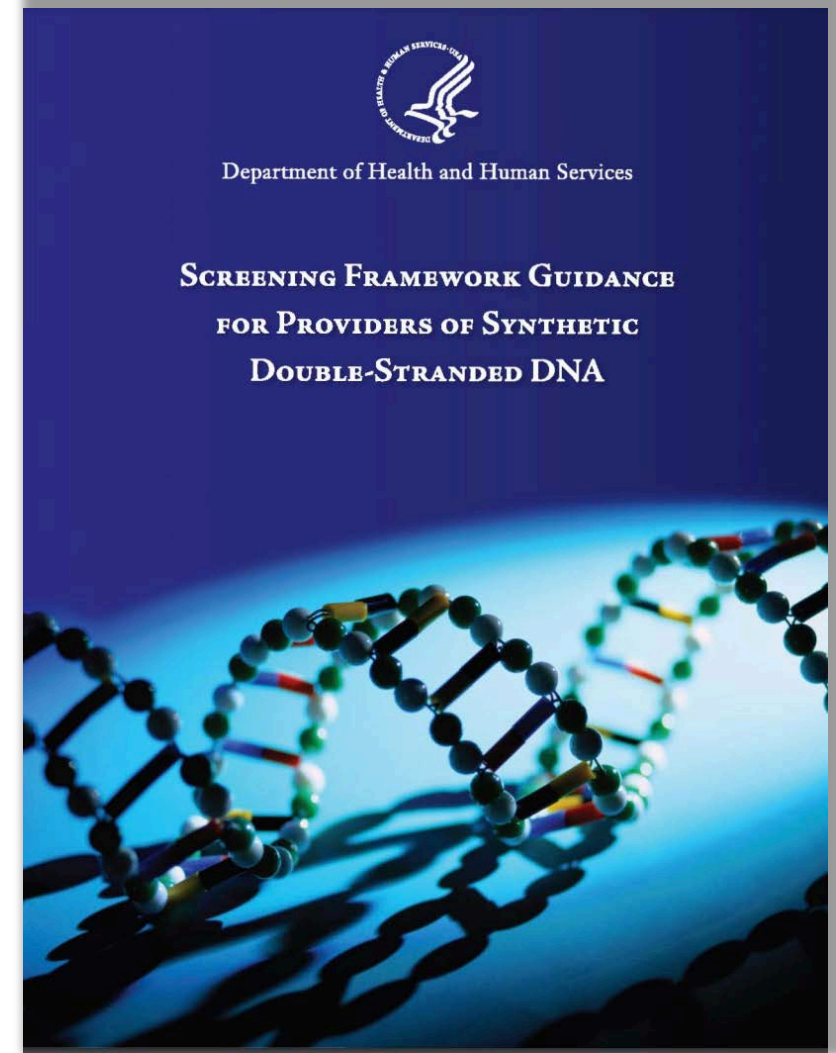
James Randerson, science correspondent

Wed 14 Jun 2006 23.59 BST

Lax laws, virus DNA and potential for terror

- Loopholes mean anyone can order gene sequences
- Scientists back voluntary regulation as first step

The screenshot shows a newspaper article layout. At the top is the masthead 'The Guardian Newspaper of the year'. Below it is a navigation bar with categories: News, Opinion, Sport, Culture, Lifestyle, and More. The main article is titled 'Weapons technology' by James Randerson, a science correspondent. The article is dated Wednesday, June 14, 2006, at 23:59 BST. The headline is 'Lax laws, virus DNA and potential for terror'. Below the headline are two bullet points: 'Loopholes mean anyone can order gene sequences' and 'Scientists back voluntary regulation as first step'. The background image of the article shows a brown paper bag with a 'SIGNED FOR' label, a small vial, and a document titled 'Certificate of Analysis'.



Department of Health and Human Services

SCREENING FRAMEWORK GUIDANCE FOR PROVIDERS OF SYNTHETIC DOUBLE-STRANDED DNA

The cover features the Department of Health and Human Services logo at the top. The title is centered in white text on a dark blue background. The bottom half of the cover shows a close-up, artistic rendering of a DNA double helix structure with colorful beads representing the base pairs, set against a blue gradient background.

What happens when things go badly

POLITICO EXPLORE NEWSLETTERS & PODCASTS

Belgian exporters found guilty of sending chemicals to Syria

Two executives receive jail terms.

BY SIMON MARKS
FEBRUARY 7, 2019 | 6:33 PM CET | 4 MINUTES READ

A Belgian court has found three businesses and their owners guilty of shipping 168 tons of a substance potentially used in the making of chemical weapons to Syria between 2014 and 2016 without submitting the appropriate export licenses.



Fighting the spread of chemical and biological weapons.

Strengthening global security.

[AUSTRALIA GROUP
COMMON CONTROL LISTS](#) →

[LEARN MORE](#)



Any ... genetic element that codes for, any of the following:

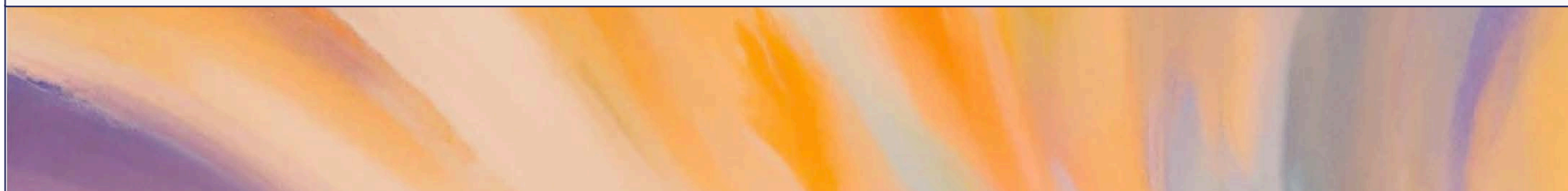
- a) any gene or genes ... specific to any listed virus; or
- b) any gene or genes specific to any listed bacterium or fungus, and which
 - i. in itself or through its transcribed or translated products represents a significant hazard to human, animal or plant health, or
 - ii. could endow or enhance pathogenicity;
- c) any listed toxins or their sub-units.

The background is a solid orange color. It features several white, thin-lined circles of varying sizes and positions. Some circles are partially cut off by the edges of the frame, while others are fully visible. The circles are scattered across the page, with a larger one on the left side and several smaller ones on the right and bottom.

HOW TO THINK ABOUT MISUSE

January 31, 2024

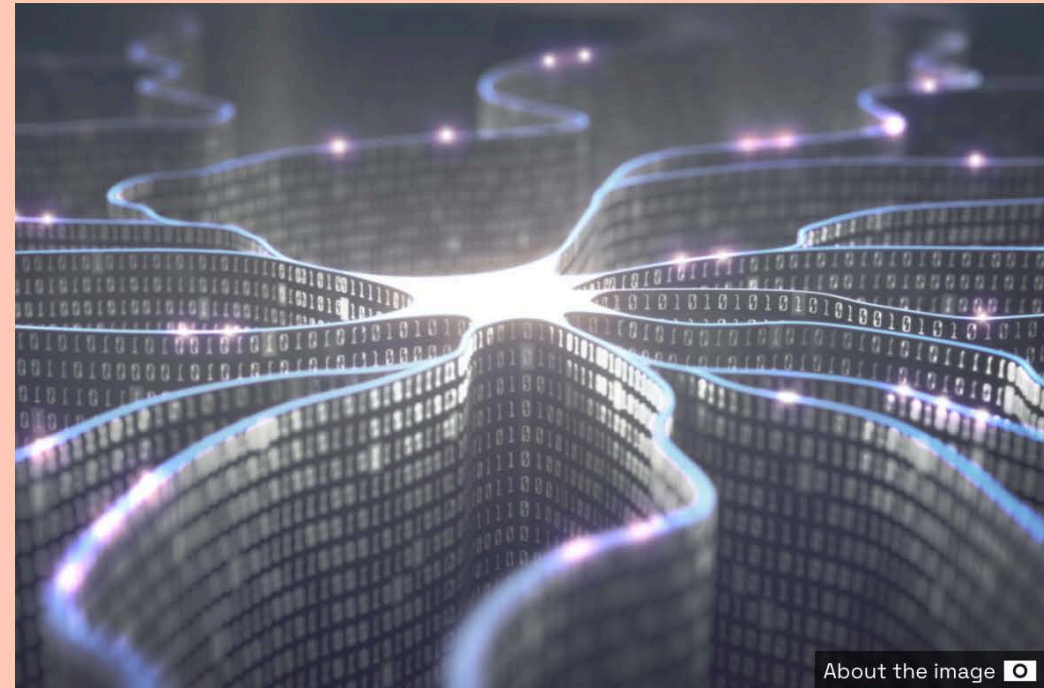
Building an early warning system for LLM-aided biological threat creation




Nov 14

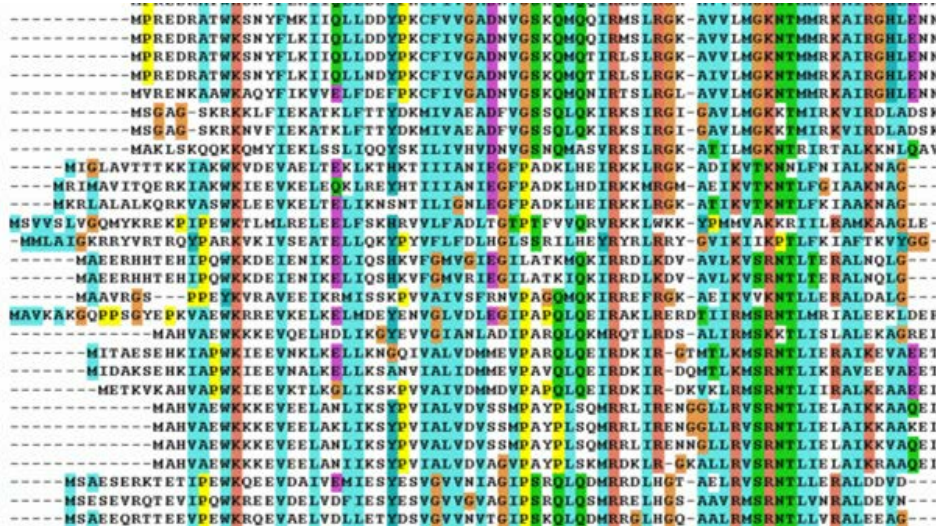
Developing Guardrails for AI Biodesign Tools

[REGISTER](#)

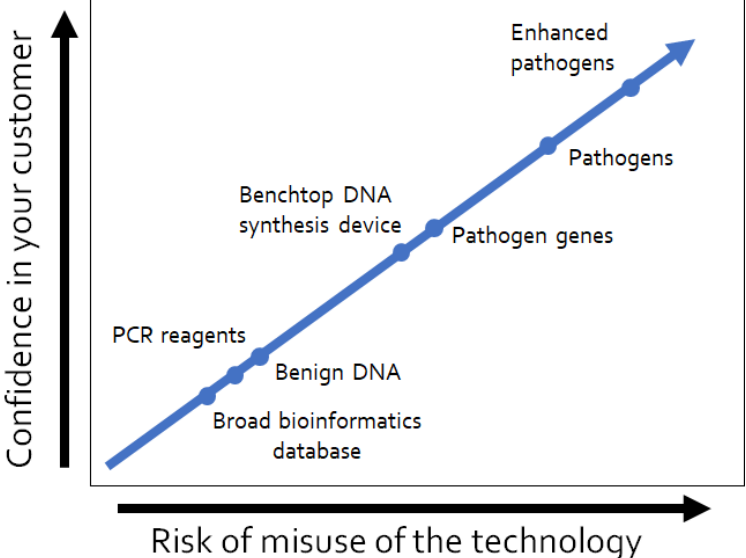


About the image 

Managing risks through screening



Sequence Screening



Customer Screening

Images: Miguel Andrade/[Wikimedia Commons](#), Sarah Carter

List of Companies and Available Tools to Assist Providers and Manufacturers in Screening Orders

<https://shorturl.at/kv2kt>

IBBIS: COMMON MECHANISM

- Free
- Flags matches at 50 base pairs or above
- IGSC Member

SECUREDNA

- Free
- Flags matches at 30 base pairs or above

ACLID

- Commercial
- Flags matches at 50 base pairs or above, capable of screening down to 30 base pairs
- IGSC Member

NCBI: BLAST

- Free
- Bioinformatics tool that can be adapted for many purposes, one of them may be screening. Providers and Manufacturers could use this tool to develop in-house screening software.

RTX BBN TECHNOLOGIES: FAST-NA SCANNER

- Commercial
- Flags matches at 50 base pairs or above
- IGSC Member

BATELLE: ULTRASEQ™

- Commercial
- Flags matches at 50 base pairs or above
- IGSC Member



**WHY THINK ABOUT
MISUSE NOW**



FRAMEWORK FOR NUCLEIC ACID SYNTHESIS SCREENING

A product of the
FAST TRACK ACTION COMMITTEE ON
SYNTHETIC NUCLEIC ACID PROCUREMENT SCREENING
of the
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

Revised: September 2024
Version 1: April 2024



Guidance UK screening guidance on synthetic nucleic acids for users and providers

Published 8 October 2024

- Contents
- Introduction
- Definitions (keywords)
- Guidance recommendations
- Customer screening
- Sequence screening
- Suspicious transactions
- Screening order legitimacy
- Record keeping
- Compliance with export controls
- Following up with the UK government in cases where malintent is suspected



International
Standard

ISO 20688-2

Biotechnology — Nucleic acid
synthesis —
Part 2:
Requirements for the production
and quality control of synthesized
gene fragments, genes, and
genomes

First edition
2024-03



Please share your feedback about
the standard. Scan the QR code
with your phone or click the link
[Customer Feedback Form](#)





FRAMEWORK FOR NUCLEIC ACID SYNTHESIS SCREENING

A product of the
FAST TRACK ACTION COMMITTEE ON
SYNTHETIC NUCLEIC ACID PROCUREMENT SCREENING
of the
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

Revised: September 2024

Version 1: April 2024

- Requires any institution receiving US Federal funds to only use synthesis providers that screen orders & customers
- Could include international institutions
- Released April 2024, Updated Sept 2024, EIF Oct 2024
- Covers **biofoundaries**
- Those making and providing synthetic DNA to self-attest they screen



FRAMEWORK FOR NUCLEIC ACID SYNTHESIS SCREENING

A product of the
FAST TRACK ACTION COMMITTEE ON
SYNTHETIC NUCLEIC ACID PROCUREMENT SCREENING
of the
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

Revised: September 2024

Version 1: April 2024

September 2024 Update

- Clarification on genes not associated with pathogenicity & virulence
- Additional self-attestation details
- Grace period for US federally funded researchers until April 2025
- Customer screening for **ALL** orders

Manufacturers

Action 1



Attest to implementing the Framework through a statement that either is posted on a public website or provided to both the federally funded customer and federal funding agency.

Action 2

Screen synthetic nucleic acids to identify sequences of concern (SOCs).



Action 3



Screen customers who submit purchase orders benchtop nucleic acid synthesis equipment to verify legitimacy.

Action 4

Report potentially illegitimate orders of synthetic nucleic acids involving SOCs or of benchtop nucleic acid synthesis equipment.



Action 5



Retain records relating to orders for synthetic nucleic acids and benchtop nucleic acid synthesis equipment.

Action 6

Take steps to ensure cybersecurity and information security.



Providers

Action 1



Attest to implementing the Framework through a statement that either is posted on a public website or provided to both the federally funded customer and federal funding agency.

Action 2

Screen purchase orders for synthetic nucleic acids to identify sequences of concern (SOCs).



Action 3



Screen customers who submit purchase orders of synthetic nucleic acids with SOCs to verify legitimacy.

Action 4

Report potentially illegitimate purchase orders of synthetic nucleic acids involving SOCs.



Action 5



Retain records relating to purchase orders for synthetic nucleic acids.

Action 6

Take steps to ensure cybersecurity and information security.





Guidance

UK screening guidance on synthetic nucleic acids for users and providers

Published 8 October 2024

Contents

Introduction

Definitions (keywords)

Guidance recommendations

Customer screening

Sequence screening

Suspicious transactions

Screening order legitimacy

Record keeping

Compliance with export controls

Following up with the UK government in cases where malintent is suspected

- Recommendations for making, providing, & using synthetic DNA (inc. constructs using them)
- Published 8 October 2024
- Includes order & customer screening
- Links to existing laws & regulations
 - Export controls
 - Domestic controls



**International
Standard**

ISO 20688-2

**Biotechnology — Nucleic acid
synthesis —**

Part 2:
**Requirements for the production
and quality control of synthesized
gene fragments, genes, and
genomes**

**First edition
2024-03**



Please share your feedback about
the standard. Scan the QR code
with your phone or click the link

[Customer Feedback Form](#)

- International technical standard for nucleic acid synthesis
- Published March 2024
- Requires lab biosafety & lab biosecurity
- Requires order & customer screening
- Provides overview of expected screening but few details

The background is a solid teal color. It features several white, thin-lined circles of varying sizes and positions. Some circles are partially cut off by the edges of the frame, while others are fully visible. The circles are scattered across the page, with some overlapping each other.

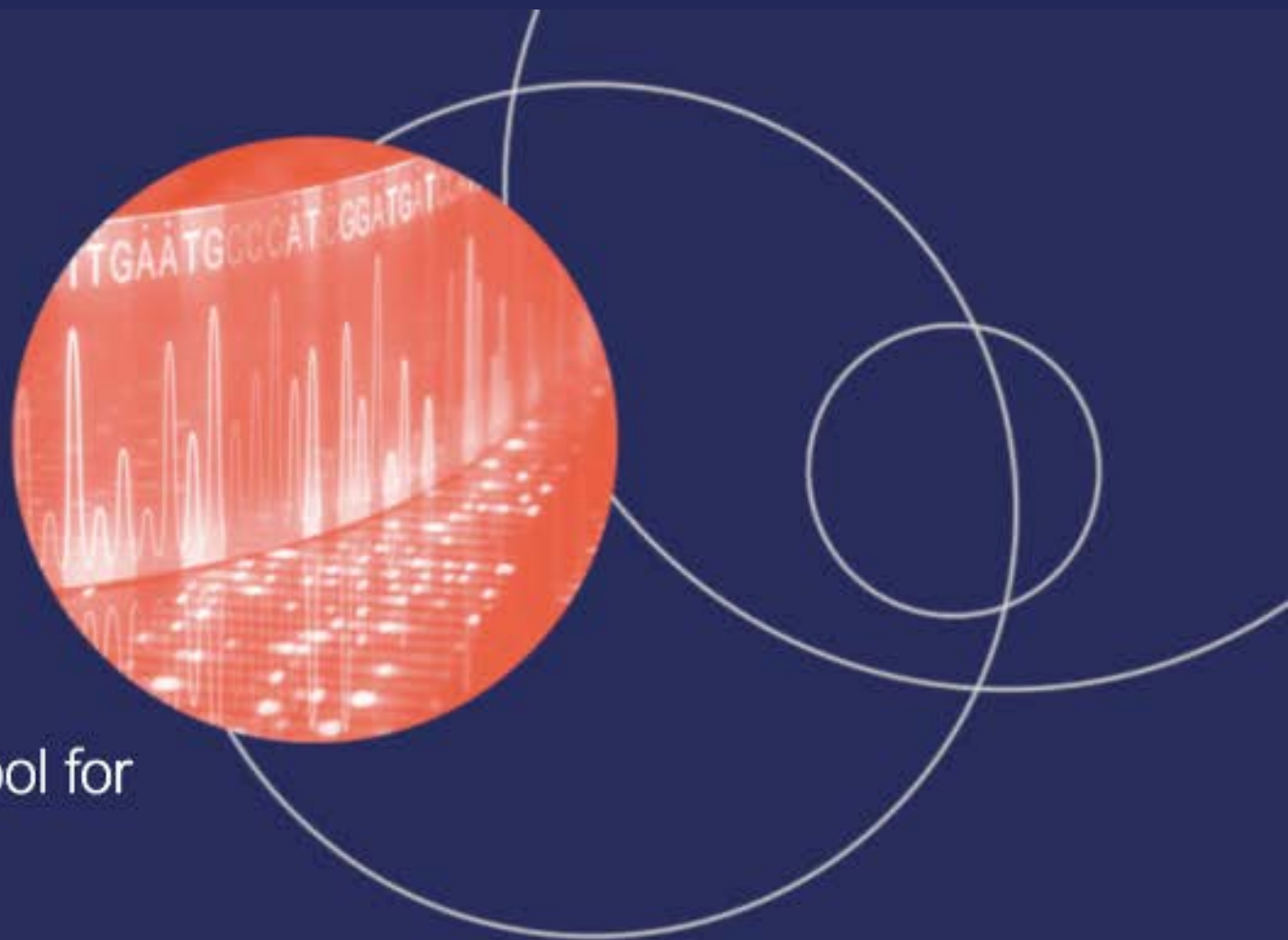
HOW WE CAN HELP

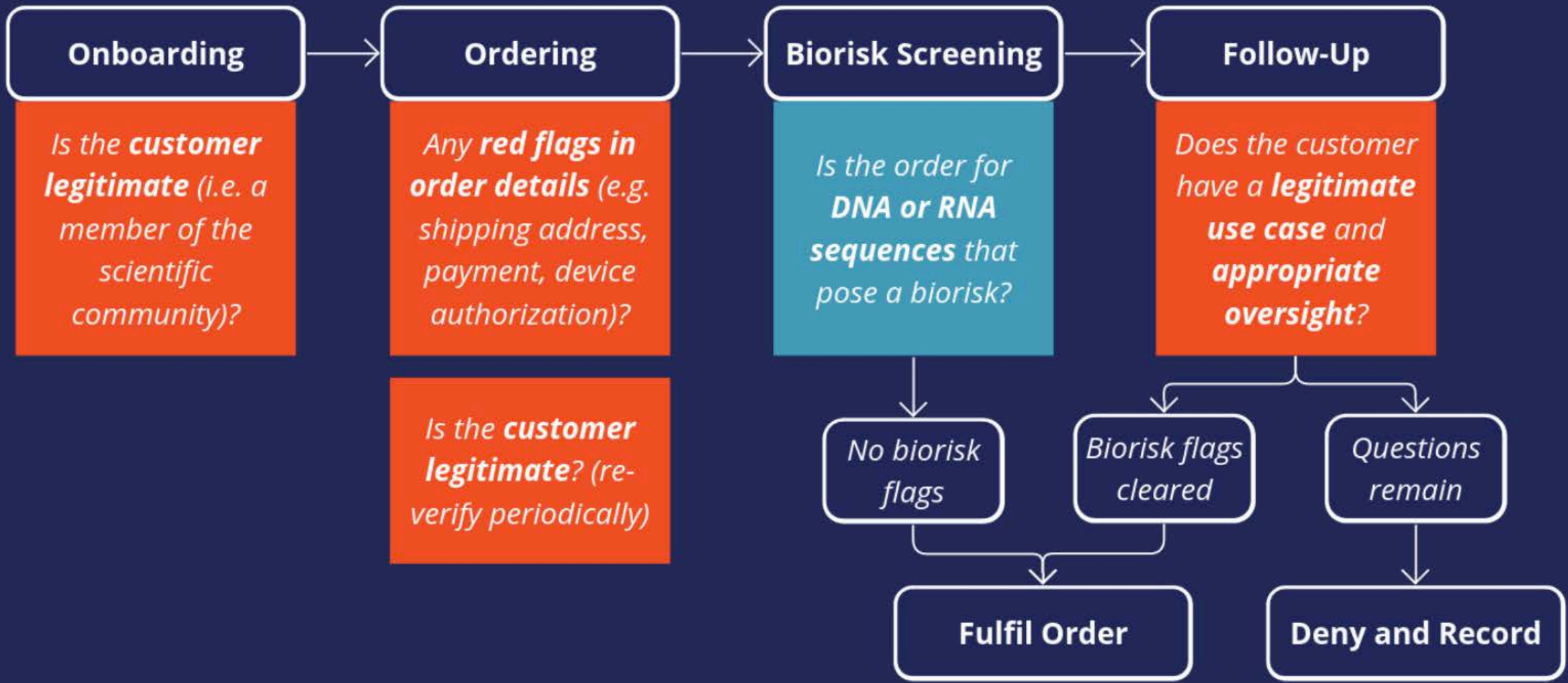
IBBIS

International Biosecurity and
Biosafety Initiative for Science

COMMON MECHANISM

A free, open-source, globally available tool for
DNA sequence screening.





Performance



- Compliance with industry best practices when tested against real order customer streams by beta testers such as Twist Bioscience
- <2% false positive flags of real synthetic biology designs
- Performance on par with industry screening tools in a standard test set
- Resilience to AI-generated challenges

You can use the Common Mechanism right now!

Free, open-source, and under continuous development.

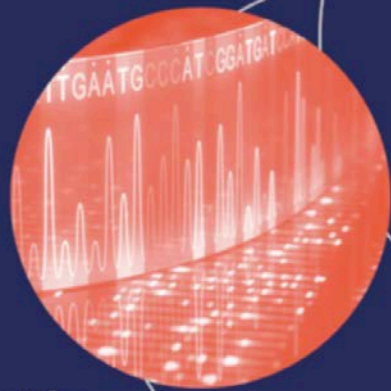


A screenshot of the GitHub repository for 'common-mechanism'. The repository is public and owned by 'alexanian'. It features a file browser with folders like '.github', 'commec', 'conda-recipe', 'dev_scripts', 'example_data', and files like '.gitignore', 'LICENSE', 'README.md', 'environment.yml', and 'pyproject.toml'. The README section is visible, titled 'commec: a free, open-source, globally available tool for DNA sequence screening'. It includes the IBBIS logo and a description: 'A free, open-source, globally available tool for DNA sequence screening.' The repository also shows 278 commits, 3 stars, 10 watchers, and 1 fork. Contributors listed include Nicole Wheeler, Jen Lu, and Tessa Alexanian. The language statistics show Python at 81.4% and Shell at 18.6%. A 'Python package' section at the bottom offers to 'Configure' the package.

IBBIS 
International Biosecurity and
Biosafety Initiative for Science

COMMON MECHANISM

A free, open-source, globally available tool for
DNA sequence screening.



WORKSHOP

- Join this afternoon
- Synthesis screening
- Customer screening
- Practical activities and active learning



THANK YOU

